

ELECTRONIC FUNDAMENTALS

SERVICE PRACTICES 2

HOW TO USE TOOLS

2-1. Use and Care of Tools

2-2. Basic Radio Tools

2-3. Screwdrivers

2-4. Pliers

2-5. Hammers

2-6. Hacksaws

2-7. Files

2-8. Buy What You Need



RCA INSTITUTES, INC.

A SERVICE OF RADIO CORPORATION OF AMERICA

HOME STUDY SCHOOL

350 West 4th Street, New York 14, N. Y.

© 1955 RCA Institutes, Inc.

Service Practices 2

INTRODUCTION

A radio and TV serviceman is judged by the tools he has, how he uses them, and how he cares for them. To start out in radio, it is not important that you have many tools. It is important that you have good tools, use them properly, and take care of them.

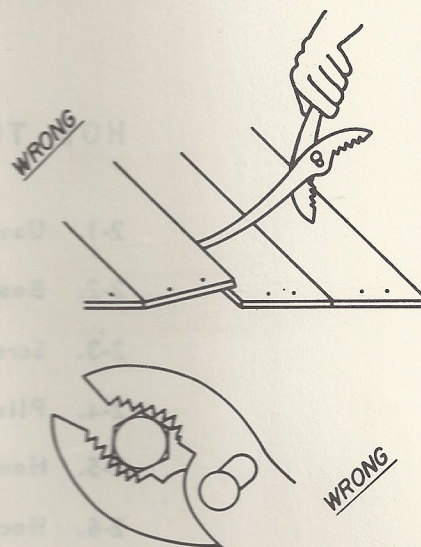
In the beginning, it may be necessary to use cheaper tools or whatever is available, without thinking about quality. However, replace them with good-quality tools as soon as you can afford to. With good tools, you actually can do better work with less effort. Furthermore, good tools often give a lifetime of service, when properly cared for, while inexpensive tools easily chip, twist, bend, or break.

2-1. USE AND CARE OF TOOLS

The way you use tools often tells others what kind of a mechanic or technician you are. Anyone who tries to pry open a wooden crate with a screwdriver or who hammers a nail with a pair of pliers shows that he doesn't know how to use tools properly. When he has finished, the screwdriver is bent or the pliers are sprung. A good serviceman uses each tool for the job it was made to do. As a result, he gets full value out of his tools and is known as a careful workman.

The care you take of your tools shows your customers the kind of treatment their radios, phono players, or television sets are likely to receive from you. When tools are allowed to get rusty, chipped, or dirty, they show all who see them that you are careless. When tools are all over the place, dropped where last used, or just dumped into a tool case or bag, people think you are disorderly. Keep tools clean. Keep them free

of rust by dipping them in light machine oil and wiping them carefully with a clean cloth. A small amount of the oil will remain to protect the tool.



do not use pliers as a pry bar or on a nut

Fig. 2-1

Each tool should have its place and should be kept there when not in use. At your workbench, tools may be placed in a rack similar to the one shown in Fig. 2-2. Tools used in a customer's home may be carried in a tool box, a tool bag, or in a flexible canvas, leatherette, or plastic roll that has a pocket or loop for each tool. Servicemen tend to lose tools by leaving them on the floor, behind the radio, in the radio cabinet, or some such place in the customer's home. This can be avoided by placing each tool where it belongs and by counting tools before leaving the customer's house. If each tool has its place, such a count may be made almost at a glance.



Reprinted by permission of *Radio-Electronics*, November 1953, copyright 1953 by Gernsback Publications

Fig. 2-2

2-2. BASIC RADIO TOOLS

While very few tools are needed to get you started, some tools are needed right away. You will need the tools shown in Fig. 2-3 as soon as you start. Some of them, such as the hammer, flashlight, and hacksaw, you probably have already. The soldering iron is given to you in Kit 1 and is the subject of Experiment Lessons 1 and 2.

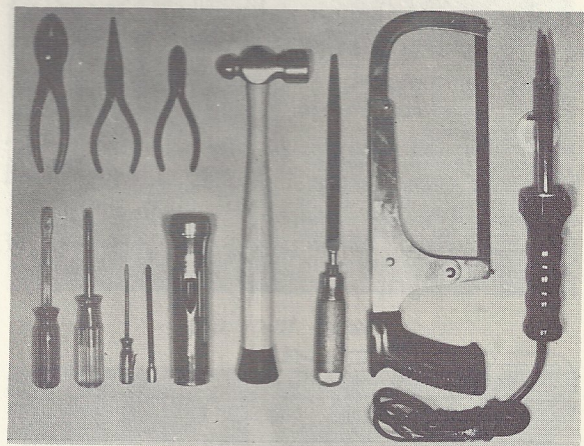


Fig. 2-3

2-3. SCREWDRIVERS

The four types of screwdrivers shown in Fig. 2-4 are basic radio and TV tools. Before long, you'll probably add several more screwdrivers to your kit. So many different kinds and sizes of screws are used on jobs that servicemen need screwdrivers with short, medium, and long blades; narrow, medium, and wide blades; thin and thick

blades; and others with tips of special design.

The familiar standard screwdriver is shown in Fig. 2-4. Most servicemen prefer a blade from 3 to 6 inches long, 1/4 to 3/16 inches wide. When buying such a screwdriver, remember the following things:

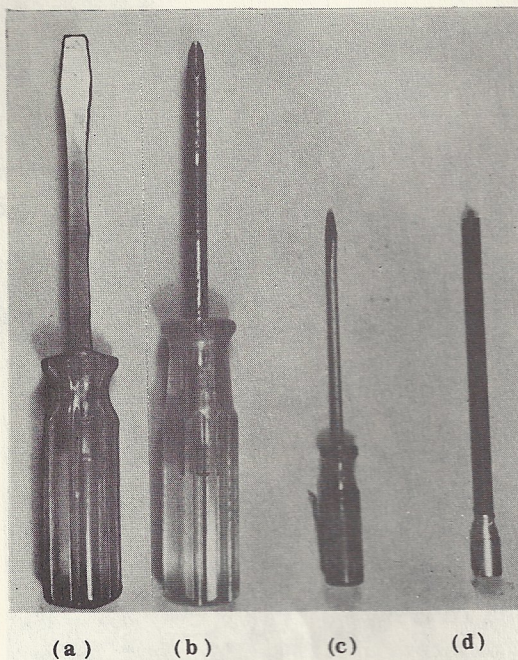


Fig. 2-4

1. The handle should be tight or so made that the shaft cannot turn inside it. Most servicemen prefer an insulated screwdriver handle that is made of plastic and molded around the blade. To prevent the shaft from turning in the handle, the end of the shaft may be formed with wings, as in Fig. 2-5, or it may be square or flattened at the end.

2. Grip the handle of the screwdriver before you buy it, to see if it fits the hand comfortably. The handle shown in Fig. 2-5 is very popular with servicemen because of its non-slip grip.

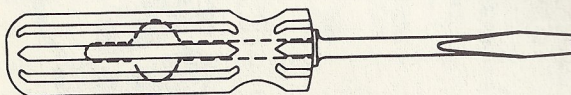


Fig. 2-5

3. The blade should not taper too much, as shown in Fig. 2-6a, but should have a slight taper, as shown in Fig. 2-6b. Too great a taper tends to make the blade slip and chew up the screw head.

4. The tip of the blade should not be rounded as in Fig. 2-6c, but should be

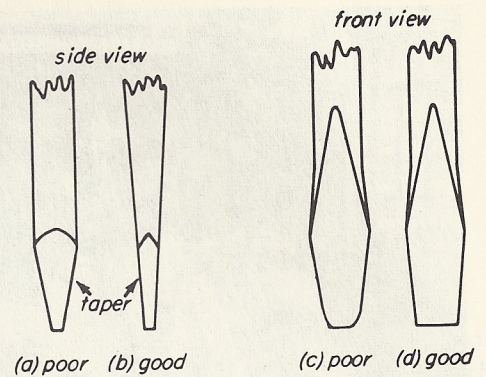


Fig. 2-6

ground so that the tip is squared off as in Fig. 2-6d.

5. Above all, buy as good a screwdriver as you can afford. The blades of cheap screwdrivers tend to twist, their tips become burred, and their shanks slip. Fine-grade screwdrivers are made of special tool steel, hardened and tempered. Many manufacturers use chrome vanadium steel, which is excellent for screwdrivers and wrenches.

When using a screwdriver:

1. Use a screwdriver that is long enough to reach the screw conveniently. Longer screwdrivers have handles with larger diameters, which make it easier to drive screws.

2. Choose a screwdriver with a blade that fits the screw head. (See Fig. 2-7.)

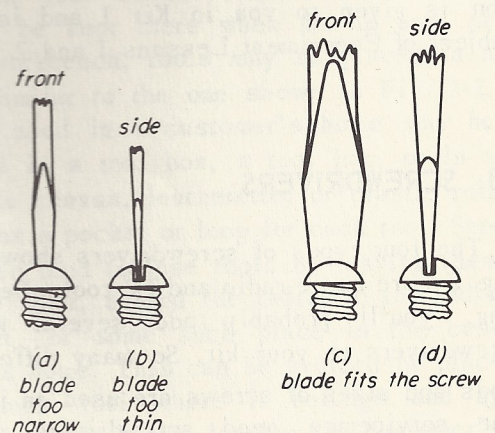


Fig. 2-7

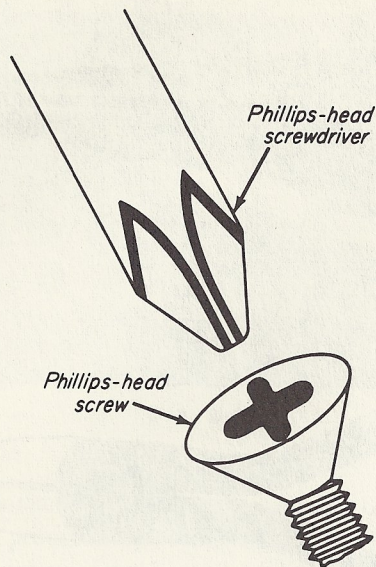


Fig. 2-8

3. Don't use a screwdriver as a chisel or a pry bar.

4. Never hammer the handle. It can break.

The screwdriver shown in Fig. 2-4b is made for Phillips head screws, one of which is shown in Fig. 2-8. The heads of these screws have a specially shaped cut that does not fit the standard screwdriver. Because many radio manufacturers use these screws, a Phillips screwdriver is part of the basic tool kit.

The screwdriver shown in Fig. 2-4c is a standard screwdriver with a very narrow blade. It is used for very small screws, such as are found in the tuning knobs of radios.

The screwdriver shown in Fig. 2-4d is called an *alignment* tool. It is used to *align* or adjust radio and TV circuits so that the station may be tuned in at the proper point on the dial.

2-4. PLIERS

Three basic types of pliers are shown in Fig. 2-9. The first type, *combination pliers* (shown in Fig. 2-9a), has a slip joint that opens the jaws of the pliers wider. This feature is illustrated in Fig. 2-10.

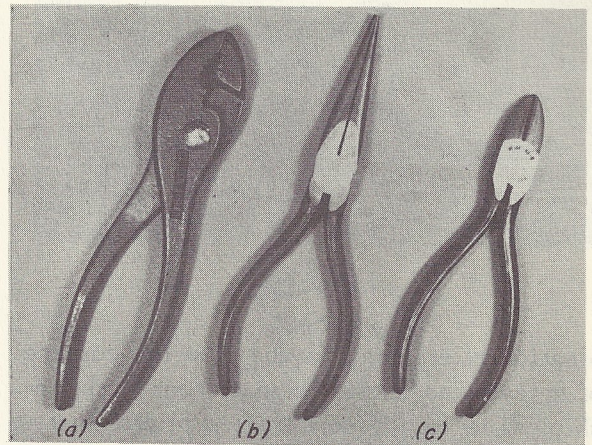
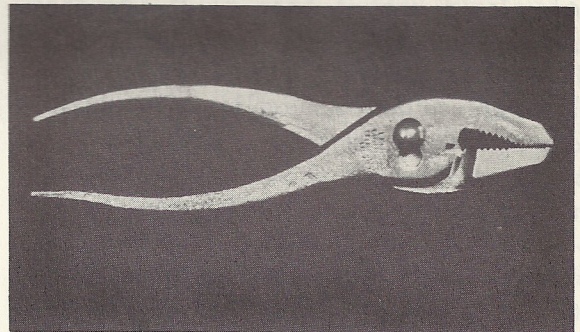
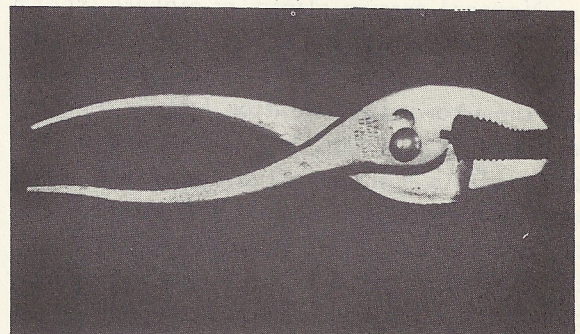


Fig. 2-9

Combination pliers are designed for use on rounded surfaces. They should not be used to loosen or tighten nuts or screws with square or hexagonal (six-sided) heads. Wrenches made to fit the particular nut or screw should be used for this purpose. Com-



slip joint closed
(a)



slip joint open
(b)

Fig. 2-10

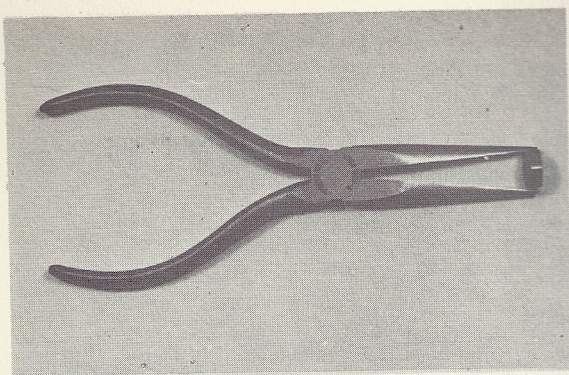


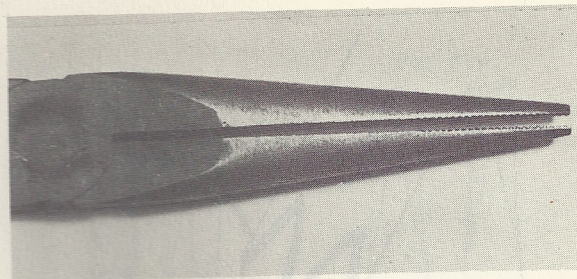
Fig. 2-11

bination pliers tend to chew up the corners of screws and nuts—a sign of poor workmanship. When buying combination pliers, insist on the best, which are made of good tool steel. The jaws should move easily but should not slip from the narrow-jaw position to the wide-jaw position when an object is gripped.

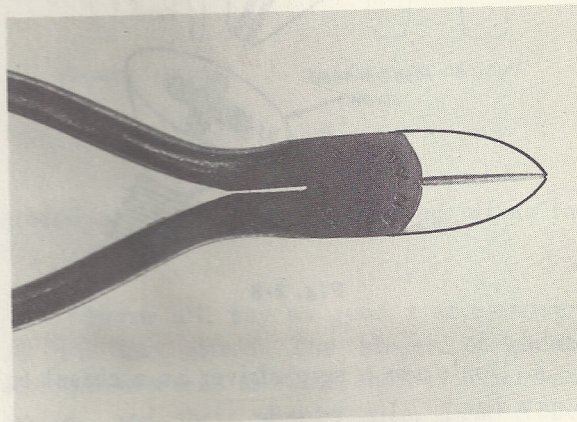
The long-nose pliers (shown in Fig. 2-9b) is one of the most frequently used radio tools. Servicemen use them to hold leads or wires in position while soldering, to bend wires into angles, and to hold small nuts when starting to thread screws into them, as shown in Fig. 2-11.

Never use long-nose pliers to tighten or loosen nuts or screws. If you do, you'll spring the jaws and the pliers will lose much of their value. When buying long-nose pliers, select the best you can afford. They should be made of first-quality tool steel and the jaws should meet (mesh) as shown in Fig. 2-12a.

Diagonal-cutting pliers, or nippers (shown in Fig. 2-9c) are used to cut small wires found in radio equipment. Some servicemen use them to strip insulation from wire. This is not good practice, because stranded wire may lose a couple of strands, and solid wire may be nicked. In either case, the wire is weakened and its safe current-carrying capacity is changed. When buying diagonal-cutting pliers, hold them up to the light to be sure that the cutting edges meet, as shown in Fig. 2-12b. Here again, it pays to buy the best.



(a)



(b)

Fig. 2-12

2-5. HAMMERS

At present, a ball-peen (machinist's) hammer is the only one shown in Fig. 2-13. A nail or claw hammer may be added to your kit sooner or later. In fact, you probably already have one, for it is in almost every family's tool box. As you know, the claw hammer is used in woodworking to drive nails, pegs, wedges, and dowels, and to drive punches, cold chisels, star drills, and so on. Servicemen also use it to tack antenna and ground wires to floor molding when running these leads to the receiver.

The size of any hammer is determined by the weight of the head (without the handle). Hammer sizes range from 5 ounces to 28 ounces. A light claw hammer is good for driving small nails; heavier hammers are used for driving larger nails, particularly into hard wood. A rule of thumb is that a hammer of the right size should drive a nail in five blows. Servicemen generally prefer an 8-ounce ball-peen hammer for general work and a 24-ounce ball-peen hammer for use with a star drill for drilling holes in brick walls.

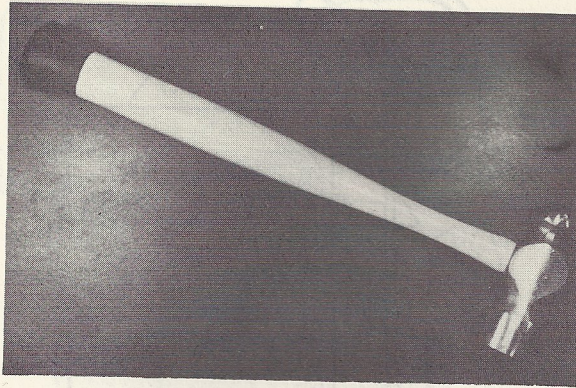


Fig. 2-13

A hammer should be grasped so that the end is practically flush with the lower edge of the palm. (See Fig. 2-14.)

In this way, the hammer does most of the work. When driving a nail into wood, hold the nail perpendicular (straight up and down) to the surface of the wood — unless, of course, you want to drive it at an angle. Place the center of the hammer face on the head of the nail, raise the hammer about an inch, and tap the nail a couple of times to start it. Then take your hand away from the nail and drive the nail into the wood. If you are using a hammer of the proper weight, it should take about five blows. Each blow should be delivered so that the hammer handle is parallel with the surface of the work. Using a ball-peen hammer is much the same as using a claw hammer. The hammer-head is in line with the punch, chisel, or star drill when it strikes.

It pays to buy a good hammer. The heads of cheaper hammers often are made by pouring molten steel into a sand mold. Such a hammer head is brittle, and may easily break. On the other hand, a drop-forged hammer head is made by hammering red hot steel alloy into a steel mold. Later it is shaped, by grinding, to an exact design and given a smooth face and beveled edges to prevent chipping. When fitted with a first-grade hickory handle, shaped to fit the hand, the hammer is well balanced and slightly springy. It's the kind of tool you like to work with.



Fig. 2-14

2-6. HACKSAWS

A serviceman must know how to use a hacksaw. It is used to cut metals, hard rubber, masonite, bakelite, and other materials that would clog the teeth and dull the cutting edge of a wood saw. Blades for hacksaws may have 14, 18, 24, or 32 teeth per inch. In general, the coarse-toothed blades are used for cutting soft stock and the fine-toothed blades are used for tool steel, thin stock, or thin tubing. It is important that the proper blade be chosen for the material to be cut.

To insert a blade, adjust the hacksaw frame to the length of the blade. The holes in the hacksaw blade are placed over the pins on the frame, as shown in Fig. 2-15a. Note that the teeth of the blade point away from the handle. Tighten the blade in the frame so that it cannot bend or buckle when sawing. The material to be sawed should be clamped tightly in a vise. (Trying to saw loosely held material leads to trouble.) If the stock is very thin, place it between two blocks of wood before clamping it in the

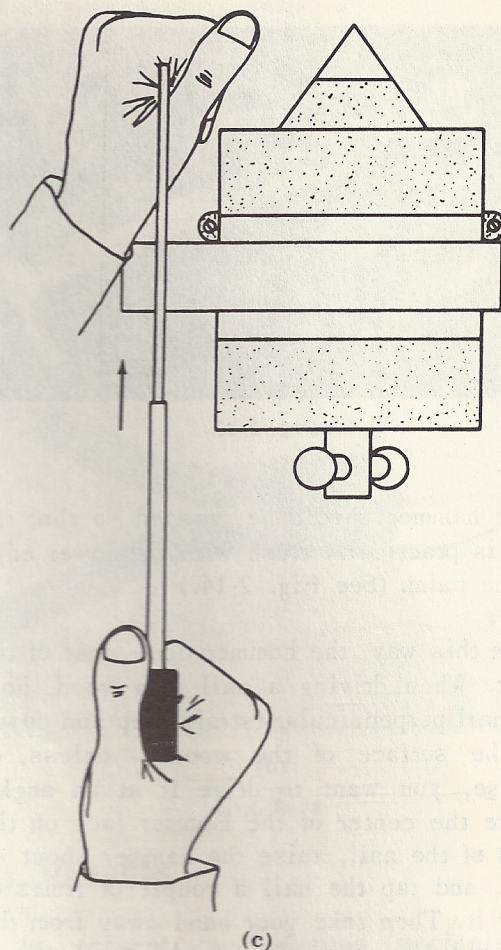
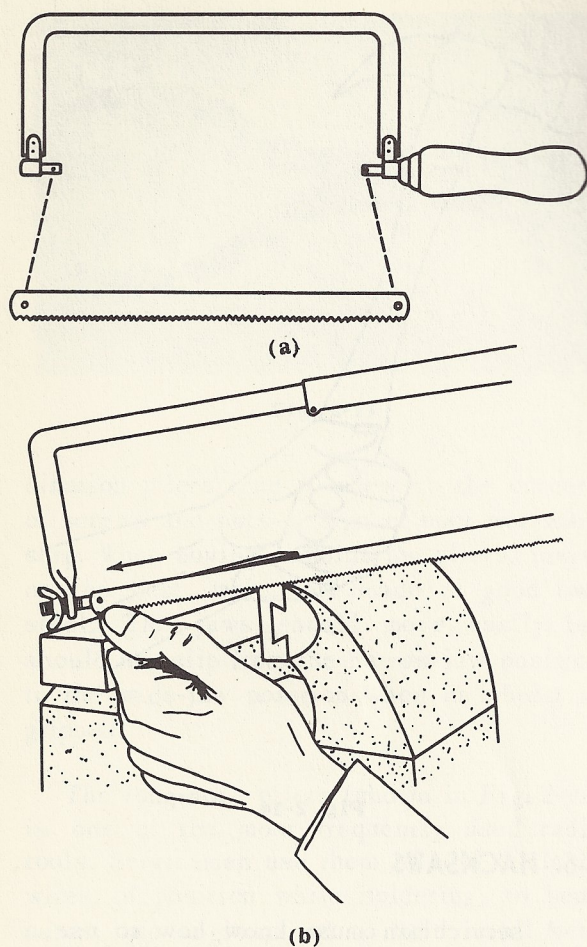


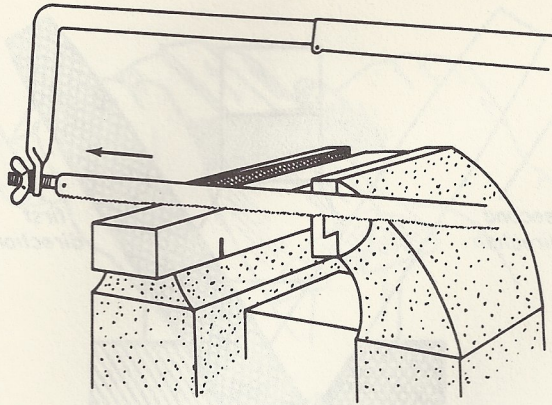
Fig. 2-15

vise. To start the cut, it is a good idea to guide the saw with the left thumb for the first few strokes. (See Fig. 2-15b.) Once the cut is started, hold the frame with both hands, as shown in Fig. 2-15c. The blade is slanted slightly forward and downward. The cut is on the forward stroke. Therefore, pressure is applied only on this stroke; there should be no pressure on the return stroke. In fact, once the cut is started, the saw may be lifted slightly away from the cut, so that the teeth barely touch the work on the return stroke. For best results each stroke should be long and steady, with no wobbling. Limit speed to about 40 or 50 strokes per minute. Most beginners tend to saw too fast and tire too easily. The experienced man works steadily, at a slower speed, and accomplishes more with less effort. If the blade heats while sawing, apply light oil in the cut or to the blade.

If a blade breaks or is too worn to complete a cut, do not try to continue the cut with a new blade. If you do, the new blade may stick in the cut and break. Instead, turn the work around, as shown in Fig. 2-16, and start a new cut in line with the first one.

Take care of your hacksaw. Wipe the blade with an oily rag to prevent rust. Hacksaw blades break easily if something falls on them, so hang them up when they are not in use. If you carry a hacksaw loosely in a tool bag, it is a good idea to remove the blade from the frame. This protects the blade, and also protects you from getting cut while rummaging in your bag for a tool.

When buying a hacksaw, get one with a pistol grip like the one shown in Fig. 2-17 or with a grip like a carpenter's saw handle. Here, again, it pays to buy the best you can afford.



Start new cut after changing blade.

Fig. 2-16

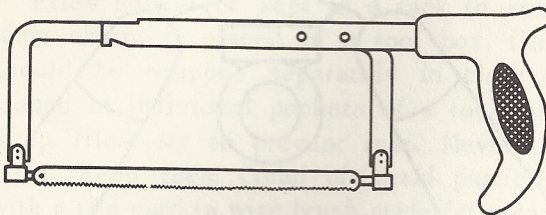


Fig. 2-17

TABLE A - HACKSAW BLADE FOR CUTTING VARIOUS MATERIALS

Material	Teeth per Inch
Aluminum; copper	14
Brass (cast); cast iron; cold-rolled, high-speed, tool, or structural steel	18
Iron pipe; brass or steel tubing	24
Thin stock and thin wall tubing	32

2-7. FILES

Servicemen find many uses for files. They are used to enlarge the holes in a chassis, to clean work before it is soldered, to smooth work after it is hacksawed, and for many other jobs. More than three thousand differ-

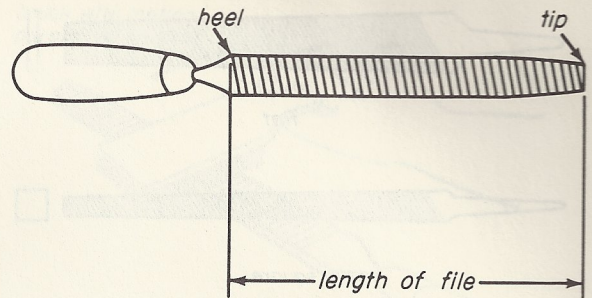


Fig. 2-18

ent files are manufactured; they differ in length, shape, cut of teeth, and degree of coarseness or fineness. The length, measured in inches, is the distance between the heel and the tip. This is shown in Fig. 2-18.

The files most commonly used are *coarse*, *bastard*, *second-cut*, and *smooth*. The second-cut might be considered standard in coarseness. The smooth is used for finishing, the bastard when faster cutting is desired. The coarse usually is used only for such jobs as removing large chunks or jags of metal. Files may be further classed according to cut: *single-cut*, *double-cut*, and *rasp*. Single-cut files are used for smooth work. Double-cut files are used when faster cutting is required. However, work done with a double-cut file is rough, and requires smoothing with a single-cut file. Rasp files are used for rapid coarse filing on wood or plastic. The number of teeth in files varies from 20 to 120 an inch. Files come in many shapes. The most common are: *flat*, *square*, *triangle*, *round*, *halfround*. They are shown in Fig. 2-19a, b, c, d, e, and f respectively.

Flat files, tapered in width and thickness, are the most commonly used. Square files, tapered on all sides, are used to enlarge square or rectangular holes. Triangle files, tapered on all three sides, are used in sharpening handsaws and trimming square corners. Round files, sometimes called *rat-tail* files, are used to enlarge round holes. The half-round file is another general-purpose file: the curved side is used on curved work, and the flat side on flat work. The flat wood rasp is used chiefly in carpentry and other woodworking.

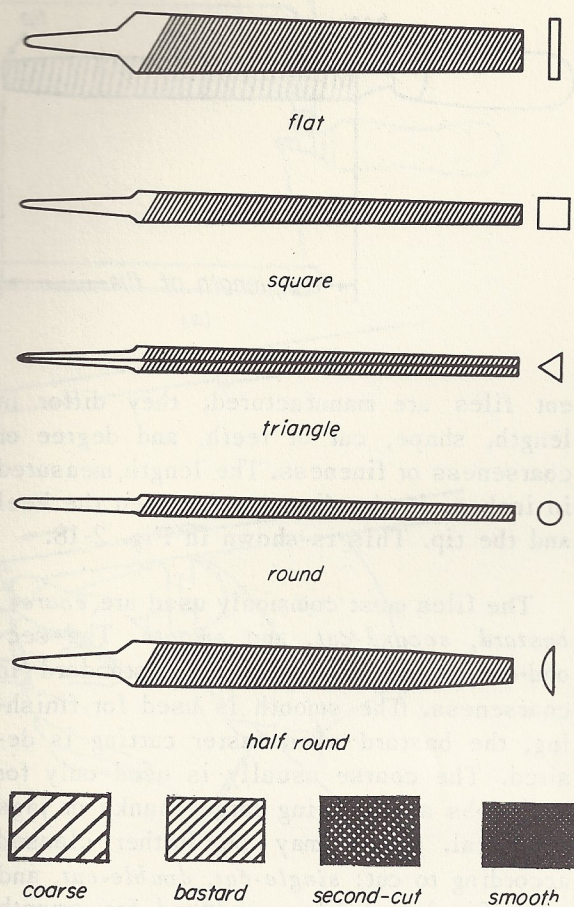


Fig. 2-19

There are two general methods of filing: *cross filing* and *draw filing*. Cross filing, which removes the most metal in the least time, is most often used. In this method, as shown in Fig. 2-20, the tip of the file is held between the thumb and first finger of the left hand, while the right hand holds the handle. Do not try to use a file without first inserting the tang into a file handle. The best type of handle is the screw-on type, shown in Fig. 2-18. The file is moved away from the body across the metal in a direction parallel with the length of the file.

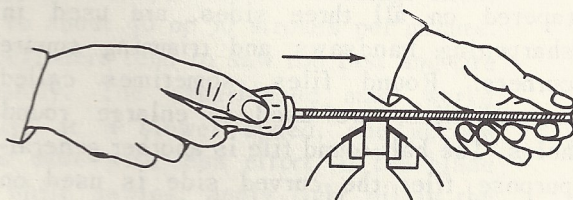


Fig. 2-20

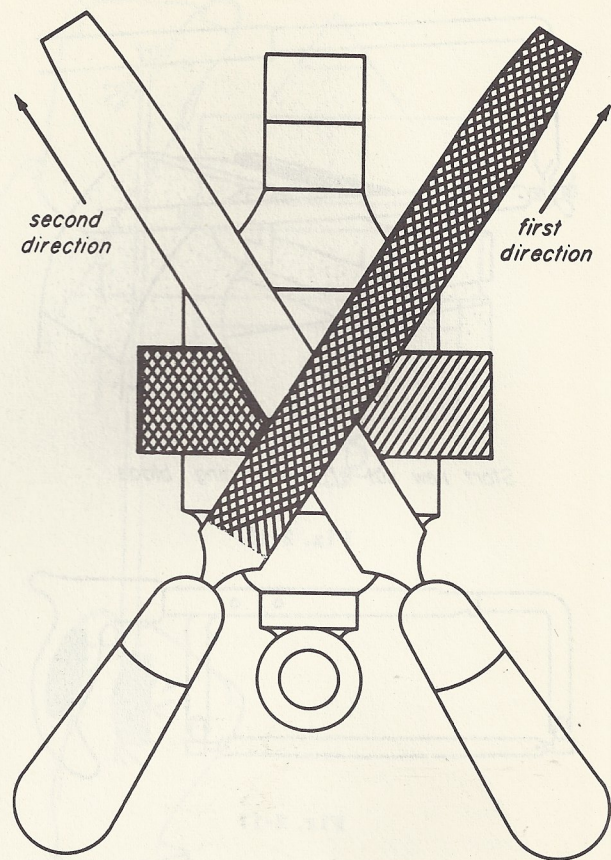


Fig. 2-21

Sometimes, on rough work with a coarse file, metal is removed more rapidly by cross stroking, as shown in Fig. 2-21. The pressure on the file depends on the coarseness and size of the file and the metal being cut. Since the file cuts only on the forward stroke, it should be lifted from the work on the return stroke. This helps protect the cutting edge of the file teeth, which would be damaged if the file were drawn across the work on the return stroke. On soft metals, it is not necessary to lift the file on the return stroke.

Draw filing is sometimes used to put the finishing touches on work that has been cross-filed to size and shape. It produces a smooth, true surface. The work is firmly clamped in the vise, and the file is drawn sidewise back and forth along the length of the work, as shown in Fig. 2-22. The cutting is done on the stroke away from the body; no

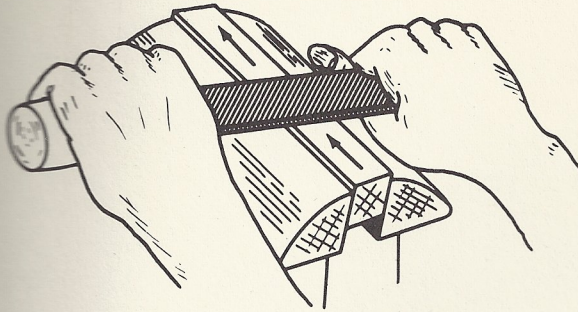
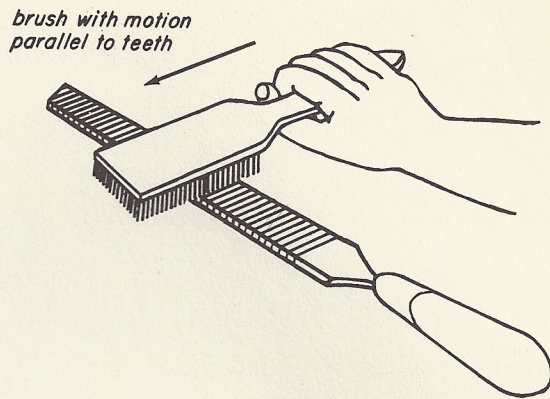


Fig. 2-22

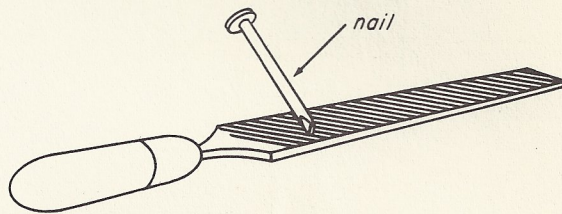
pressure is applied to the file on the return stroke.

Files should be kept in a rack to keep them sharp. If placed in a tool box, files should be wrapped separately in cloth or placed in individual pockets of a tool roll. Keep files dry to prevent rust. Never oil them. Keep them clean of metal particles with a file card (a wire brush made for cleaning files, shown in Fig. 2-23a) or a soft iron nail whose tip has been flattened out (Fig. 2-23b). Files do not clog as much if rubbed with chalk before filing.

When buying files, get the type best suited to the job to be done. For the basic tool kit, get a double-cut, half-round, medium-length bastard file. You can do many filing jobs with this file.



(a)



(b)

Fig. 2-23

2-8. BUY WHAT YOU NEED

All the tools described, and others, are used by servicemen. As your work increases and you can afford more tools, by all means add to your tool kit. However, do not buy tools until you need them and can afford good ones. A few good tools are much better than many poor ones. Other tools are discussed in later booklets.